

The New Panama Canal and North Carolina: Potential Economic Impacts and Opportunities

Prepared for:
Chris Schwinden, North Carolina Department of Commerce

Prepared By: Michael Chiulli
Master of Public Policy Candidate
The Sanford School of Public Policy
Duke University
Faculty Advisor: Michael Walden

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SECTION 1: EXECUTIVE SUMMARY

Background

The Panama Canal expects to complete the construction of a third deepwater waterway in 2015. This should change global shipping lanes in ways that the shipping industry cannot predict yet. Many experts predict that this change will increase shipping towards the East Coast ports, particularly for shippers from the US's major trading partners in Asia. As a result, several of the major ports on the East Coast have already invested billions of dollars into upgrading their port infrastructure to accommodate these changes. Additionally, the manufacturing sector's rebound from both structural and cyclical changes gives ports further reason to believe that their investments will reap benefits.

North Carolina's port infrastructure, natural geography, and capabilities lag behind its surrounding competing ports of Charleston, Savannah, and Norfolk. Because of these deficiencies, North Carolina struggles to serve its import and export markets with its ports. For example, many industries in Charlotte ship through Charleston, and many industries in Raleigh ship through Norfolk. However, not all trade will be conducted on large Post-Panamax (and larger) ships, giving North Carolina hope that it can capture some of the spillover from other ports. This project expects the canal expansion to increase port traffic in North Carolina's two ports, thus affecting the state's import and export supply chains.

Methods

We conduct multiple regressions for both the Port of Wilmington and the Port of Morehead City to predict the level of trade volume in increments of five years into the future. Once arriving at this data, we convert it to trade value and then use IMPLAN economic impact modeling software to obtain economic value-added numbers. In short, the Port of Wilmington's trade volume almost consistently increases, whereas the Port of Morehead City's growth stagnates. In order to encapsulate the uncertainty of the Panama Canal effect on the North Carolina ports, we conduct a sensitivity analysis at 10%, 20%, and 30% effect sizes for each port individually before combining the results.

Results

Using past years as the predictor, we expect the state of North Carolina's port activity to add \$30.6 billion worth of economic impact in 2014 across the state of North Carolina. By 2029, we predict the total economic impact to be \$41 billion, assuming that the Panama Canal has zero effect on global shipping. This number swells to \$45.1 billion for a 10% Panama Canal shipping bump, \$49.1 billion for a 20% bump, and \$53.2 billion for a 30% bump. Today the North Carolina ports contribute approximately 184,000 jobs in the state. They also provide \$2.1 billion worth of revenue for the state from the economic activity generated by the ports.

Conclusions and Implications









North Carolina faces many impediments to achieving its maritime shipping potential. Crumbling infrastructure, geography, delayed construction of the canal, and competing ports could thwart progress at the ports. The North Carolina ports operate much closer to their total capacity than do their competing ports. Even holding constant the effect of the Panama Canal expansion, North Carolina can expect to outgrow its ports in 20 years. The state should invest in the surrounding infrastructure to supplement and catalyze the growth of their ports.

SECTION 2: BACKGROUND

Current Panama Canal situation

The Panama Canal Authority expects to complete its expansion of a third deepwater lane in the Panama Canal in 2015, barring further disputes between the Panama Canal Authority and the Spanish construction consortium Sacyr.¹ This third deepwater shipping lane will approximately double the shipping capacity of the canal as a global trade thoroughfare. In constructing a third canal lane with depths of 60 feet, it will be able to accommodate New Panamax ships, the largest cargo vessels in the world. Many ports on the East Coast have already invested millions of dollars with the expectation of capturing this predicted new trade volume.

Figure 1: Historic Size of Container Ships²

		Length	Draft	TEU
First (1956-1970)	 Converted Cargo Vessel	135 m	< 9 m < 30 ft	500
	 Converted Tanker	200 m		800
Second (1970-1980)	 Cellular Containership	215 m	10 m 33 ft	1,000 – 2,500
Third (1980-1988)	 Panamax Class	250 m	11-12 m 36-40 ft	3,000
	 Panamax Class	290 m		4,000
Fourth (1988-2000)	 Post Panamax	275 – 305 m	11-13 m 36-43 ft	4,000 – 5,000
Fifth (2000-2005)	 Post Panamax Plus	335 m	13-14 m 43-46 ft	5,000 – 8,000
Sixth (2006-)	 New Panamax	397 m	15.5 m 50 ft	11,000 – 14,500

Additionally, global trade has rebounded since its immediate decrease after the Great Recession.³ Despite this momentary lapse, imports and exports steadily grow as globalization forces becomes stronger and stronger. Five percent of global trade passes through the canal, making it tremendously strategic.

Expected Impacts of Panama Expansion on East Coast

Four out of the United States' top five trading partners are on the continent of Asia (China, Japan, South Korea, Taiwan.) China accounts for nearly half of the TEUs

¹ Kriel and Dowsett. Feb 2014.

² Container Transport website.

³ CPB Netherlands Bureau for Economic Policy Analysis website.

(Twenty-foot equivalent unit, the standard shipping container) imported into the United States, and over a fifth of exported TEUs.⁴ As a general rule, waterborne cargo transportation remains the cheapest way to ship, particularly for distances exceeding 400 miles. Currently the most efficient way to trade from Asia to the East Coast is for ships to dock in California and ship their cargo overland via rail or truck. Too many ships attempt to navigate the Panama Canal and cause the ships to wait for days outside of the canal. Many shippers from Asia forgo this loss in time value of money, choosing the overland route from California or the Suez Canal instead. A third waterway should significantly reduce wait time costs, making shippers reconsider their shipping route choices.

Using data from the US Department of Transportation's Commodity Flow Survey of 100,000 organizations' shipping costs, Mitchell compared the costs of shipping from China to the East coast by varying modes.⁵

Figure 2: Average Waterborne Shipping Cost

Route	Container Size (TEU/FEU)	Average Cost
Singapore to US East Coast (Water)	20	\$2,501
	40	\$3,081
Singapore to US West Coast (Water)	20	\$1,730
	40	\$2,100
Shanghai to US East Coast (Water)	20	\$3,101
	40	\$3,621
Shanghai to US West Coast (Water)	20	\$2,220
	40	\$2,620

⁴ National Association of Development Organizations Research Foundation. 2012.

⁵ Mitchell. 2011.

Figure 3: Average Multi-mode Shipping Cost

Route/Mode	Container Size (TEU/FEU)	Average Cost
Singapore to Savannah (Water- Rail)	20	\$2,913
	40	\$4,444
Singapore to Savannah (Water- Truck)	20	\$3,852
	40	\$6,323
Shanghai to NY (Water-Rail)	20	\$3,658
	40	\$5,465
Shanghai to NY (Water-Truck)	20	\$4,611
	40	\$7,371

As demonstrated in Figure 2 and 3, the all-water route from select locations in Asia to the East Coast is considerably cheaper. Using the most extreme example, the fastest shipping option for a forty-foot equivalent unit container from Shanghai to the East Coast (New York or Savannah) is approximately \$3,000 more than the all-water option. Shippers do consider delivery speed a major consideration, and the all water route through the Panama Canal adds approximately 10 days to the West Coast and overland shipping option. However, cost is the primary concern for shippers, and the third waterway should also help to decrease the disparity in shipping speed.

No consensus exists regarding the effects of the Canal expansion on the East Coast ports, but the majority of experts believe that vessel calls will shift from the West Coast to the East Coast as shipping costs to the East Coast further diminish with the opening of the third Panama Canal lane.

A preliminary 2008 report by the US Army Corps of Engineers reported that the Gulf and East Coasts expect more traffic “as cargo shifts away from the congested West Coast.”⁶ However, Joseph O-Reilly of Inbound Logistics disagrees, saying that uncertainty surrounds the East/West shipping route debate but acknowledges that shippers will have more options to choose the most efficient shipping method.⁷ Further, the NC Maritime Trade Report recognizes the possibility that the deepwater, lock-less Suez Canal could undermine the impact of the new Panama opening.⁸ A later USACE report called the canal expansion a “game-changer” for the US over the long term.⁹

⁶ Knight, 2012.

⁷ O'Reilly. 2012.

⁸ “NC Maritime Strategy Final Report.” p. 49.

⁹ Army Corps of Engineers, June 2012. pp. 43-44.

Another report by the Southern Legislative Conference predicted, albeit with some uncertainty, that “in a post-Panama Canal expansion world, many of the [East and Gulf ports] stand out as major beneficiaries.”¹⁰ The Seven Portals Study, a transportation and economic report commissioned by the State of North Carolina, wrote the, “Panama Canal will have profound effects on the ports of call for the worlds container ship fleet.”¹¹

The prediction of increased port traffic has spurred many East Coast ports to dredge their waterways in order to accommodate the New Panamax ships. For example, Miami has invested \$2 billion to upgrade its port facilities¹², New York/New Jersey has invested over \$1 billion to raise the Bayonne Bridge and dredge waterways¹³, Baltimore dredged its depths to 50 feet, and Savannah has invested \$650 million to upgrade port infrastructure¹⁴. The competing ports seek to establish themselves as global trade hubs. Only Baltimore and Norfolk possess channels with sufficient depth to accommodate the New Panamax ships, so other ports faced a decision of whether to dredge to these depths.¹⁵

The Panama expansion could result in another potential outcome: the hub-and-spoke port pattern. This pattern is defined as a system of connections where one deepwater port acts as the “hub” and other tributary ports act as the “spokes” via cabotage between ports. Academia has vigorously debated the merits of multiple ports versus hub-and-spoke networks. The literature suggests that no system is a panacea, where the most cost effective transportation means depends on each unique situation. In the hub-and-spoke system, feeder ships would transport cargo from the Neo-Panamax ships that could call in New York or another port that has expanded its deepwater capabilities to Wilmington or Morehead City.

While imports almost certainly will continue increasing, US exports should continue to rebound as well. Ships will less frequently enter the ports full and leave empty. However, since 2009 during the most severe effects of the recession, US exports as a percentage of GDP has steadily risen. The decreased shipping costs associated with the improved ports will also serve as a boon for the US manufacturing industry. Decreased shipping costs will contribute to manufacturing’s competitiveness and will stimulate the US economy. The combination of the short-term shock of the Panama Canal expansion coupled with the anticipated long-term trend of rising global shipping will only serve to further increase shipping on the East Coast and in North Carolina.

Expectations of Impacts on North Carolina Ports

¹⁰ CanagaRetna, p. 17.

¹¹ List, p. 17.

¹² Johnson. 2012.

¹³ Clifford. 2012.

¹⁴ Ehl. 2012.

¹⁵ Ackerman. 2013.

We recognize that a connection exists between transportation infrastructure and economic development. The ports are connected to a web of interrelated and interdependent means of transportation, including rail, highways, and airplanes. Studying the impact of the ports without the context of the larger means of connecting them to the rest of the state is dishonest. However, conducting a comprehensive analysis of the state's transportation infrastructure system exceeds the scope of this project.

North Carolina lacks the port infrastructure depth to accommodate the New Panamax ships. When more waterways are dredged past their natural depth, the greater the recurring costs to maintain these depths. The long, winding, shallow Cape Fear River imposes higher dredging costs for the Port of Wilmington, but the state can afford the dredging because the Army Corps of Engineers (USACE) repeatedly provides grants for dredging for the two ports because of its military.¹⁶ The state exports a small yet consistent amount of military wares through both of its ports. USACE also periodically provides federal money to dredge the Cape Fear River, as shipping must traverse 26 miles of the naturally shallow Cape Fear River.

For a highly populated, manufacturing-based, coastal state, North Carolina has a disproportionately low number of ports when compared to other states. Its two ports at Wilmington and Morehead City are small on the national scale, ranking 60 and 81 in trade volume, respectively. More alarmingly, North Carolina's surrounding competitors of Charleston, Savannah, and Norfolk dwarf North Carolina's ports and their capabilities. In addition to its inferior size, North Carolina's geography works against it, where the surrounding ports' harbors possess a greater natural depth. They are generally located closer to the ocean than North Carolina's main container port, Wilmington, and consequently travel a shorter distance to open ocean.

Consequently, the state seriously considered constructing an international deep-water port at Southport when the NC State Ports Authority purchased a \$30 million tract of land for its potential construction in 2006. However, local interest groups, environmental factors, the \$2.5 billion price tag, and ensuing political firestorm thwarted the statewide movement for this port.¹⁷ North Carolina did not possess the coastline or geographic parameters to accommodate the new Post-Panamax ships. The hub-and-spoke model suggests that the absence of a deepwater port does not mean that its two seaports will become obsolete. While the state will not likely have a huge international global port in the foreseeable future, the state government can adopt a few alternatives to help streamline supply chains. Each port has its own special capabilities and peculiarities and will be examined separately before holistically.

Port of Morehead City

¹⁶ "NC Maritime Strategy Final Report." pp. xviii and 18.

¹⁷ CH2M Hill, Inc. p. 7.

The Port of Morehead City has great natural depth and a short distance of only four miles to the sea buoy. The port ships bulk and break bulk cargo, but does not house container capabilities. Many markets in Raleigh choose to ship via the Norfolk port due to the infrastructure deficiencies connecting Morehead City to Raleigh. The Department of Transportation has emphasized the I-70 Commission as a means to connect Raleigh, the Global Transpark in Kinston, and the Port of Morehead City together. Figure A3 in the Appendix shows various projects planned by the state on I-70. Figure A1 shows Morehead City's shipping totals by cargo type.

Both the 2001 and 2008 recessions deeply impacted the bulk capabilities of the port. Overall, Morehead City's total port traffic has gradually declined. Most of the variation stems from the bulk cargo, where break bulk comprises such a small share and maintains relative consistency. Morehead City is bolstered by its strong phosphate export industry, as the largest phosphate mine in the world is located 60 miles away in Aurora, NC. Since 2004, North Carolina has exported less than a million tons of phosphate in only 2013, suggesting not only its historic strength but also its potential more recent decline.

Currently, many soybean growers in North Carolina ship through other states because North Carolina has no bulk grain facility. North Carolina already has a numerical advantage over other states in grain elevators, where soybeans farmers could cheaply ship to Morehead City via the Norfolk Southern line or to Wilmington via the CSX line. Soybeans account for 10% of total state agricultural exports and account for 18% including feed grains and wheat.¹⁸ Morehead City's undeveloped Radio Island appears an ideal location for creating bulk grain facilities. This facility would decrease supply chain costs, which are then indirectly borne by consumers, and would provide additional traffic through the NC ports.

Port of Wilmington

The larger Port of Wilmington must ship 26 miles on the winding Cape Fear River. The US Army Corps must dredge the channel every two years due to the makeup of the river. Wilmington has container terminal capabilities in addition to bulk and break bulk cargo facilities. After the channel's dredging from 38-foot depth to 42 feet in 2004, Wilmington experienced an uptick in port traffic from its capacity to handle most Panamax ships. The Cape Fear River's winding route presents an additional limiting factor, where ships exceeding 950 feet in length cannot navigate the 95 degree bend near the river's mouth. Because of this structural limitation, it makes little engineering sense to dredge the Cape Fear River to further depths.¹⁹

When compared to the surrounding competing ports at Norfolk, Charleston, Savannah, and Jacksonville, Wilmington operates closest to its overall capacity. Even

¹⁸ NC Maritime Report, p 73.

¹⁹ Risingwater Associates, p. 26.

holding the impact of the Panama Canal expansion constant, for a 5% annual growth, this growing port will reach capacity in 2029. Conversely, at a 5% rate of growth, the ports at Hampton Roads (Virginia Beach), Charleston, and Savannah will reach their capacities in 2041, 2034, and 2040, respectively. While the purpose of this report does not seek to advocate for port expansion, it will be a necessity in the next 20 years in North Carolina when we outgrow our ports.

Figure A2 shows Wilmington's total cargo traffic by commodity type. We observe general increases in container and bulk cargo but a decline in break bulk cargo. Woodpulp has anchored the export industry, and ranks first or second of the state's top commodity exports since 2003. Additionally, North Carolina's main exporter, China, arbitrarily banned imports from South Carolina and Virginia from 2011 to 2012, shifting some of the shipping patterns in North Carolina's favor.²⁰ Since woodpulp is an input for plywood and other building materials, the housing market collapse negatively impacted this industry, but it has rebounded with the economic recovery. NC exported only 208,021 tons of woodpulp in 2008 but exported 342,462 tons in 2013.

Charlotte's inland terminal is 206 miles and 3.5 hours from the Port of Wilmington, whereas the terminal is 212 miles and 3.2 hours from the Port of Charleston. To access the Port of Wilmington, truckers must travel across the entire length of the sprawling city of Charlotte, because the terminal is located on the northwest side. All of the cargo moving through Charlotte will eventually go to either Charleston, Savannah, or Wilmington. Figures A4, A5, and A6 in the appendix show maps produced by Gulf Engineering & Consultants and Moffatt and Nichol for the Save the Cape project. The light green area shows where the port of Wilmington has a cost advantage, whereas the darker green area shows where Wilmington's shipping costs are within \$50 of other ports. The map illustrates that Raleigh chooses to ship primarily via Hampton Roads in Norfolk instead of Wilmington or Morehead City. It also demonstrates the Wilmington's difficulties capturing trade moving through Charlotte's markets, since Charleston and Savannah. While Wilmington's container charges compare very favorably to other surrounding competing ports, fewer trains run from the port because of the diminished traffic moving through the port. These infrequencies delay shipping times and increase resultant inventory costs.

Long-term demographic trends also necessitate that North Carolina invest in its ports to keep pace. The Regional Plan Association expects the Piedmont Atlantic Megaregion, a corridor comprising Raleigh-Durham, Charlotte, Atlanta, and Birmingham, to see its population nearly double by 2050.²¹ In the entire Southeast, IHS Global Insights expects exports to double in the next 10 years. The ports at Wilmington and Morehead City approach their capacity and must expand to accommodate the rising demand.

²⁰ Barris. 2013.

²¹ America 2050 website.

Assuming imports and export activity continues to rise on an aggregate level globally and statewide, warehousing and distribution facilities must exist to manage and ship the cargo. Adequate railroads and highways will be critical in connecting the ports with these distribution centers and thus the retail markets. Private distribution companies will be looking to expand in North Carolina, whose ports are connected via a railroad network and the I-95 corridor.

The port boom could serve as a much needed economic stimulant to the poor region of Eastern North Carolina. In an area with significant economic troubles, the port activity and subsequent necessary warehousing and distribution centers could provide long-term unemployed manufacturing workers relief, benefitting the entire state. North Carolina has a comparative advantage for serving NC markets, because its ports are located in Eastern North Carolina, where land is comparatively cheap to other ports.

Additionally, North Carolina's cost of doing business ranks favorably compared to surrounding states. These forces give North Carolina a favorable climate and good prospects for developing an emerging export economy. The following table in Figure 4 from Moody's Cost of Doing Business Review shows a comparison across several indicators.²²

Figure 4: Cost of Doing Business for North Carolina and Surrounding States

	Cost of Doing Business		Unit Labor Cost		Energy Cost		Tax Burden	
State	Index	Rank	Index	Rank	Index	Rank	Index	Rank
NC	84	50	83	49	81	34	94	30
VA	97	26	101	17	86	28	85	42
SC	95	28	100	22	86	29	80	47
GA	98	20	101	16	89	27	92	33
TN	89	41	89	46	96	20	78	48
FL	102	13	102	13	116	15	94	27

Only 18% of exports and 22% of imports move through North Carolina. In light of this, the state offers a tax credit to businesses that use the NC ports. Alarming, less than 5% of exports from Charlotte move through the NC ports, and businesses choose Savannah or Charleston instead.

Specifically, this project seeks to answer three of the following questions: (1) How will the North Carolina ports in Wilmington and Morehead City be impacted by the new cargo? (2) Will there be an inland terminal, warehousing, and servicing centers developed in North Carolina, what location will it reside, and how much economic benefit, tax revenue, and labor force impact will these provide? (3) How will the Panama

²² NC Maritime Strategy Final Report 2012, 65.

Canal expansion affect North Carolina exports? Generally, the goal of this project is to provide the North Carolina Department of Commerce's International Trade Division with the most accurate available information on how experts expect the Panama Canal to affect North Carolina.

SECTION 3: METHODS

Summary of Methodology

We require estimates of future trade volume for North Carolina's two ports. Such data are unavailable, then the best way to arrive at these numbers will be to run a regression using observed values of trade volume from past years to project future volume. The Federal Highway Administration releases a Freight Analysis Framework that "integrates data from a variety of sources to create a comprehensive picture of freight movement among states and major metropolitan areas by all modes of transportation."²³ Unfortunately, this tool excludes information on freight moving through the seaports. The NC Ports Authority does provide historic trade data by commodity, which will serve as a baseline. While this framework does not adjust for the anticipated Panama Shock, we use the projections as a baseline from which to conduct a sensitivity analysis.

Once imports are at the port authority, it will be useful to know as much detail as possible about the nature of the cargo. Supply chain knowledge is critical to understanding where the trade flows will go. According to expert Dr. George F. List, who has done similar projects in the past, modeling software would be ideal in creating a picture of future trade flow patterns. However, limited resources prevents this option, and our second best alternative will be to use existing reports to gain a qualitative picture of where the trade flows will go.²⁴ Such existing reports include the Seven Portals Study, the North Carolina Maritime Strategy Report, and other similar reports from neighboring states.

Lastly, once trade flow information is sufficiently gathered, we attach numerical dollar values to these flows to provide an economic impact report. We use the economic modeling software IMPLAN, which will account for various multiplier effects. Through this, we can hopefully obtain values for public sector revenue that various levels of government will collect. Also, ideally finding a number of jobs created by the port activity could be useful for the Department of Commerce.

Warehousing

North Carolina has several opportunities for warehouse and multi-modal transfer facilities, much like the Global TransPark in Kinston, North Carolina. The Seven Portals Study chose the future junction of I-95 and I-74 near Monroe, Laurinburg, Maxton due to its proximity to military bases and potential for access to CSX rail lines. Most importantly, a site here would give Charlotte a intermodal terminal on the east side of

²³ Freight Analysis Framework website.

²⁴ List: George, F. (personal interview, December 2, 2013)

Charlotte, making it cheaper for Charlotte to import and export out of Wilmington, and more likely that shippers would choose Wilmington over Charleston or Savannah.²⁵

Cargo Estimates by Port

Port of Wilmington

The Port of Wilmington's annual total tonnage has gradually risen over the past 14 years. Figure A2 in the appendix illustrates Wilmington's annual total tonnage since 1999. Port traffic increased 29% from 2004 to 2005 after the Cape Fear channel depth increased from 38 to 42 feet, because this new channel depth could accommodate Panamax ships with proper proportions. Since 1999, even with the negative effects of the Great Recession, the Port of Wilmington has seen its port traffic increase an average of 6.6% every year. Its growth has accelerated in recent years, according to the least squares regression. In 2012 and 2013, port traffic increased by 24.4% and 21.3%, respectively.²⁶ In such a small sample of only 14 observations, one data point can skew the entire distribution, but this is the overarching trend.

When partitioned by cargo type, the port elicits general trends of a decline in break bulk cargo but increases in bulk cargo and container shipping. Break bulk cargo traffic peaked in 2005 at 1,71,417 tons shipped, but reached a low amount in 2010, shipping only 207,335 tons.

Container cargo and bulk cargo have sustained the Port of Wilmington's promising growth. Container cargo in Wilmington shows a spike after the 2004 dredging project until the Great Recession and its subsequent sharp rebound in 2010. Since 1999, break bulk cargo has decreased at an average rate of 1.81% per year, bulk cargo has increased at an average rate of 12.71% per year, and container traffic has increased at an average rate of 8.99% per year. The NC ports attributed its strong growth in bulk cargo in 2012 to its wood chip exports, due to the lagging rebound in the global housing market.²⁷

We conducted a simple least squares regression of past tonnage from 1999 to 2013 to gain a baseline of potential future cargo movement. The regression in figure A6 shows the model that projects trade traffic into future years. The correlation of this regression is strong, at $R^2 = .79$.

Port of Morehead City

The smaller Port of Morehead City has experienced less robust growth than the Port of Wilmington, and growth appears flat or negative in the long term. Unlike the Port of Wilmington, the Port of Morehead City does not house container capabilities, thus

²⁵ List, 60.

²⁶ Data and projections from publicly available data from the North Carolina Ports Authority website.

²⁷ News Releases, North Carolina Ports Authority. 2014.

limiting Morehead City's shipping potential. Again, Figure A1 shows the total tonnage since 1999 moving through the Port of Morehead City.

The recessions of 2002 and 2008 greatly impacted the traffic moving through the port. Again, we ran a simple least squares regression of past tonnage from 1999 to 2013 to gain a picture of potential future cargo movement. Both bulk and break bulk cargo are stagnant or have actually contracted over the long term. While the average break bulk growth from 1999 to 2013 is 3.1%, see a general decline in break bulk cargo growth, and its strongest years were prior to 2008. Conversely, bulk cargo's growth has remained stagnant.

Those attempting to predict the effect of the Panama Canal on the East Coast ports must accept the considerable uncertainty attached to their forecasts. Unless the complexion of the Morehead City port changes, one cannot expect many significant changes in its cargo projections. However, much like the Port of Wilmington experienced an increase in its overall port traffic in 2004 after the channel depth was dredged from 38 to 42 feet, Wilmington could experience a spike in container traffic.

SECTION 4: RESULTS

Sensitivity Analysis Projections

We choose to conduct the sensitivity analyses for each separate port. Due to the absence of reliable and readily available trade projections for the North Carolina ports, we use a sensitivity analysis to estimate the Panama Canal effects. This uses 0%, 10%, 20%, and 30%, which are arbitrarily chosen values to give some scope of impact of the Panama Canal. The 0% figure represents no impact from the Panama Canal expansion. Due to data limitations where port data is listed in tons, the data must be converted into values. Using conservative estimates from the Federal Freight Analysis Framework for import and export values specific to North Carolina, one ton equates to \$3,000 of trade value. Below are the two sensitivity analyses for the ports in Wilmington and Morehead City that describe the amount of trade value that moves through the ports.

Figure 5: Port of Wilmington Sensitivity Analysis, Total Trade Value (in billions)

	2014	2019	2024	2029
0%	\$13.7	\$16.4	\$19.1	\$21.9
10%	\$15.1	\$18.1	\$21.1	\$24.0
20%	\$16.4	\$19.7	\$22.9	\$26.2
30%	\$17.8	\$21.3	\$24.9	\$28.4

The Port of Morehead City demonstrates our regression's drawbacks of a small sample size. Depending on whether the regression begins in 1999 or 2002, the resultant slope of the regression line oscillates from negative a negative projection to a positive projection. Also, due to the greater variance of the Port of Morehead City's annual traffic

totals, the R^2 only equals .192. The following sensitivity analysis accounts for all years since 1999.

Figure 6: Port of Morehead City Sensitivity Analysis, Total Trade Value (in billions)

	2014	2019	2024	2029
0%	\$5.4	\$4.9	\$4.3	\$3.7
10%	\$6.0	\$5.4	\$4.7	\$4.1
20%	\$6.5	\$5.8	\$5.2	\$4.5
30%	\$7.1	\$6.3	\$5.6	\$4.9

Total Trade Value

Figure 7 is a combined sensitivity analyses of both the Port of Wilmington and Port of Morehead City that potential impact of the Panama Canal expansion on economic trade value. This was accomplished by simply adding the two ports totals.

Figure 7: Sensitivity Analysis for North Carolina, Total Trade Value (in billions)

	2014	2019	2024	2029
0%	\$19.1	\$21.3	\$23.4	\$25.6
10%	\$21.0	\$23.4	\$25.8	\$28.2
20%	\$23.0	\$25.5	\$28.1	\$30.7
30%	\$24.9	\$27.7	\$30.5	\$33.3

Economic Impact on the State

While the numbers in Figure 7 account for the value of the cargo moving through the ports, it fails to account for multiplier effects. To capture the entire value-added economic impact on the state, we use the widely accepted IMPLAN program's coefficients. The total impact includes impacts in the sector of interest, supply chain impacts, as well as household spending impacts.²⁸ Transit by water provides \$1.60 per dollar of trade volume that passes through NC's ports.

Figure 8: Total Economic Value-Added on North Carolina (in billions)

	2014	2019	2024	2029
0%	\$30.6	\$34.1	\$37.5	\$41.0
10%	\$33.7	\$37.5	\$41.3	\$45.1
20%	\$36.7	\$40.9	\$45.0	\$49.1
30%	\$39.8	\$44.3	\$48.8	\$53.2

The 0%, 2014 data point in Figure 8 shows the total estimated economic value that the NC ports will contribute before the Panama Project is completed. Assuming that

²⁸ These multipliers from IMPLAN economic impact modeling software.

the Panama Canal expansion has no effect, by 2029 that number will be \$41 billion of economic value. Depending on the impact of the expansion, by 2029 the total impact could span between \$45 billion and \$53 billion. While these values may appear to be overly inflated, the Port of Houston contributed \$178 billion in economic value-added in 2012.²⁹

Effect on Employment

This study also estimates the number of jobs that accompany this total economic impact. The port authority creates 6 jobs per every \$1 million of port activity. These jobs could be in the trucking industry, port authority, freight shipping industry, manufacturing, other parts of the supply chain, etc. A simple calculation tells us that today the North Carolina the ports contribute to approximately 183,610 jobs. Assuming that the Panama expansion has no effect, the number of jobs provided by the ports should swell to approximately 245,740.

By 2029, if the Panama Canal increases port activity by only 10% from its current rate of growth, that job total will increase to 270,313 jobs. That is a difference of 24,573 jobs from the baseline level, a massive level of job creation that will permeate the entire state. In a best case scenario of 30% increase in traffic from the Panama Canal expansion, we predict an increase of 73,721 jobs. These predictions would account for everything affected by the maritime trade industry: manufacturing jobs, gains from cheaper imports and exports, jobs provided directly by the port authority, trucking jobs, etc.

Tax Revenue

The ports of Wilmington and Morehead City also serve as valuable revenue streams for the state of North Carolina. The state of North Carolina collects 7 cents in state and local tax revenue for every dollar of economic impact.³⁰ Therefore, holding constant the bump from the Panama Canal expansion, in 2014 the state can expect to collect \$2,142,114,000 worth of total tax revenue from the economic activity generated by the North Carolina ports.

SECTION 5: CONCLUSIONS AND IMPLICATIONS

Potential Impediments

North Carolina faces many potential hurdles when achieving its maritime trade potential. Problems with a few key highways could dull the growth potential of the Panama expansion. Low road quality of I-70, I-74, I-73, and I-95 could turn shippers away from North Carolina to other states. The winding geography of the Cape Fear River and the impractical location of the Port of Wilmington could turn some Panamax ships away from being able to ship to North Carolina. More disputes between the Panama Canal Authority and construction contractors could further delay the opening of the

²⁹ Martin Associates. 2012.

³⁰ US Census. State and Local Government Finance. 2011.

Panama Canal expansion. Obviously, other competing ports that offer cheaper shipping costs or deeper water can absorb maritime trade otherwise bound for North Carolina. For example, North Carolina fights an uphill battle against economies of scale with the larger surrounding ports. Due to the lack of trade volume, Morehead City has only one train depart per day, whereas Charleston has many leaving per day, thus reducing shipping time and inventory costs. Lastly, politics could also play a role in derailing any upgrades to the ports.

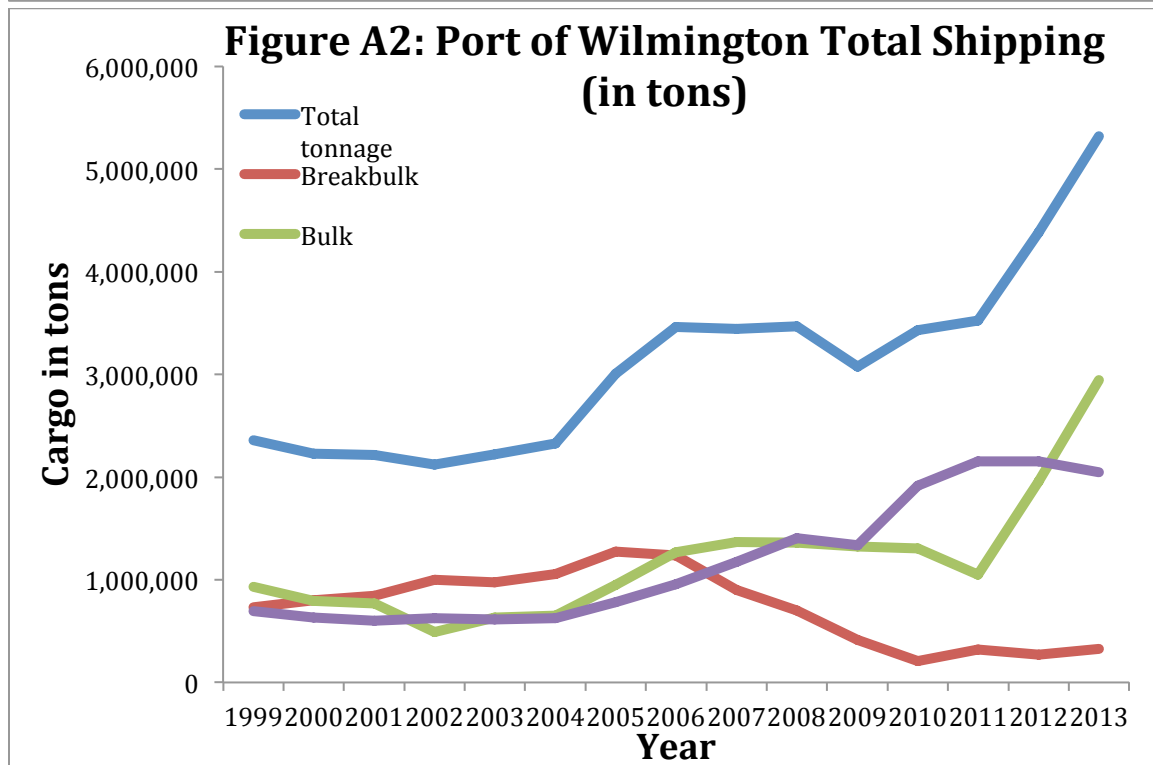
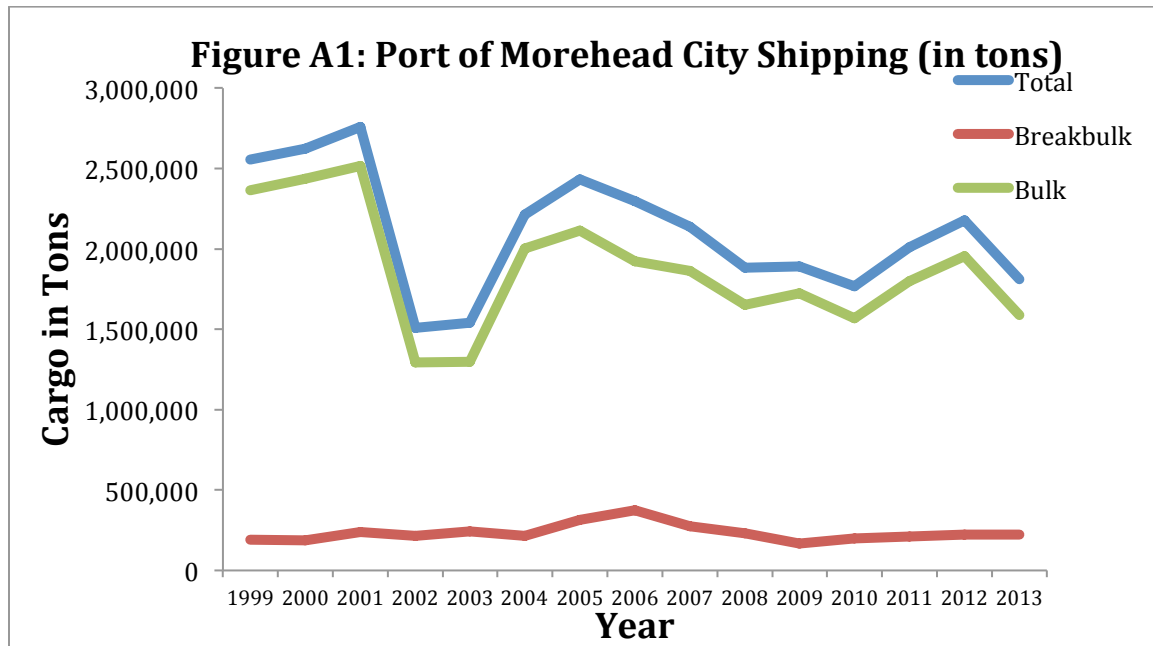
Conclusions

Even when holding constant the Panama Canal expansion, the two North Carolina ports will see trade growth over the next few years. The Panama expansion will only catalyze this growth. We have conducted a sensitivity analysis of 10%, 20%, and 30% increases to account for this uncertainty. It is impossible to discern the level of impact that the Panama Canal will impose, but experts do think that it will positively affect trade volume on East Coast ports. The expansion could fundamentally change the complexion of global shipping, but other factors could neuter this impact. The much deeper Suez Canal could provide an alternative to the Panama Canal for China and India shipping to the East Coast.

The North Carolina ports also operate much closer to their capacities than the surrounding competing ports, and the state must expand its ports to keep pace with its operations. Even without a bump in trade traffic resulting from the canal expansion, North Carolina can expect to outgrow its ports in the next 15 to 20 years. This time period could shorten depending on the size of the canal expansion impact. The state should not remain idle simply because it cannot handle the few largest ships from the new Panama Canal traffic. Not all shipping will be conducted on larger ships, despite the trend towards progressively bigger ships.

It is imperative that the state catalyzes, accommodates, and adapts the ports to the potential growth opportunities. North Carolina could add container capabilities to Morehead City and install additional refrigeration or roll-on/roll-off capabilities to both ports. The refrigeration capabilities would significantly enhance the state's agricultural export industry. Morehead City could build an in-state bulk grain facility to capture the state soybean industry's shipping potential. The state already has more grain elevators than surrounding states, making efficient rail access possible. Also the state must further develop the surrounding highway infrastructure that will support the state's supply chain. Most shippers utilize trucking as the primary means of trade, and quality highways could make the difference between shipping out of Wilmington instead of Charleston or Norfolk. The state should pursue every available upgrade option outside of deepwater dredging to allow our ports and manufacturing industry to realize its full potential.

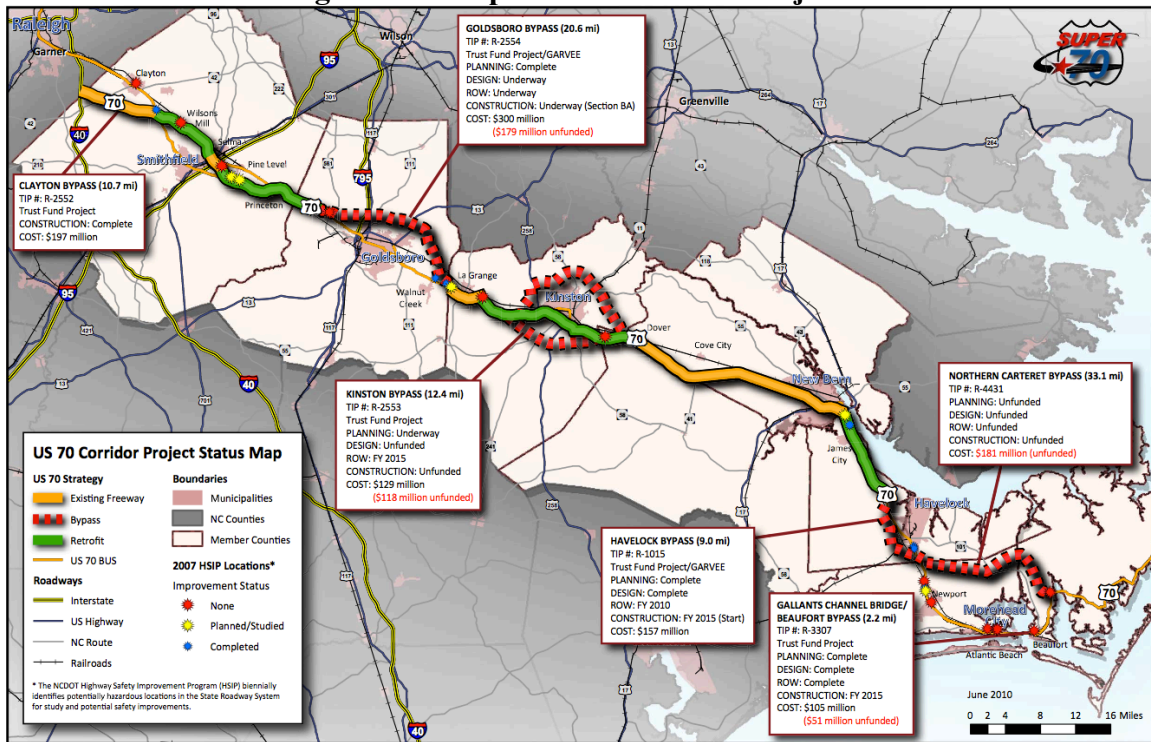
SECTION 6: APPENDIX



Source: North Carolina Ports Authority³¹

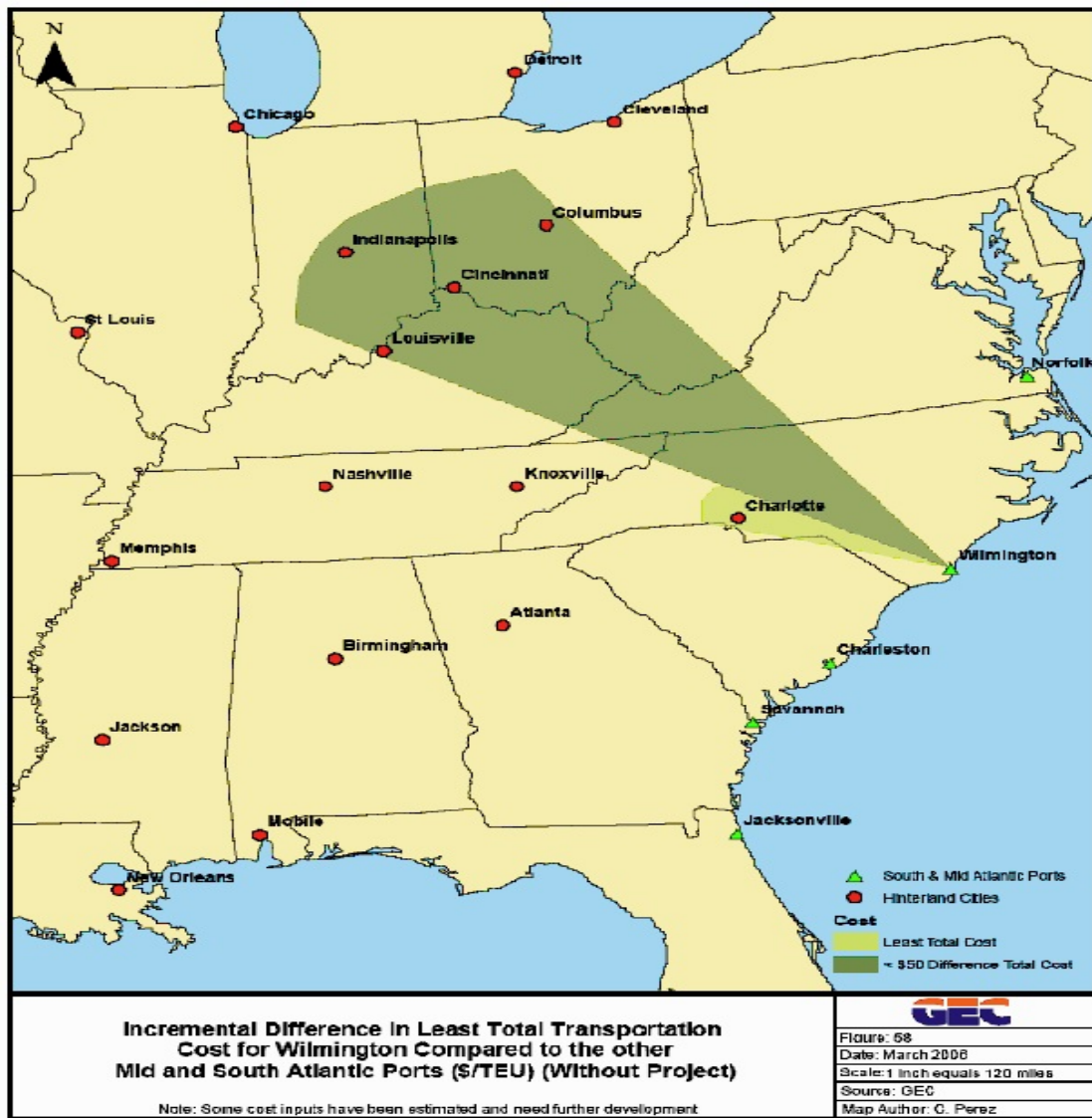
³¹ More data from the North Carolina Ports Authority website.

Figure A3: Map of I-70 Corridor Projects³²



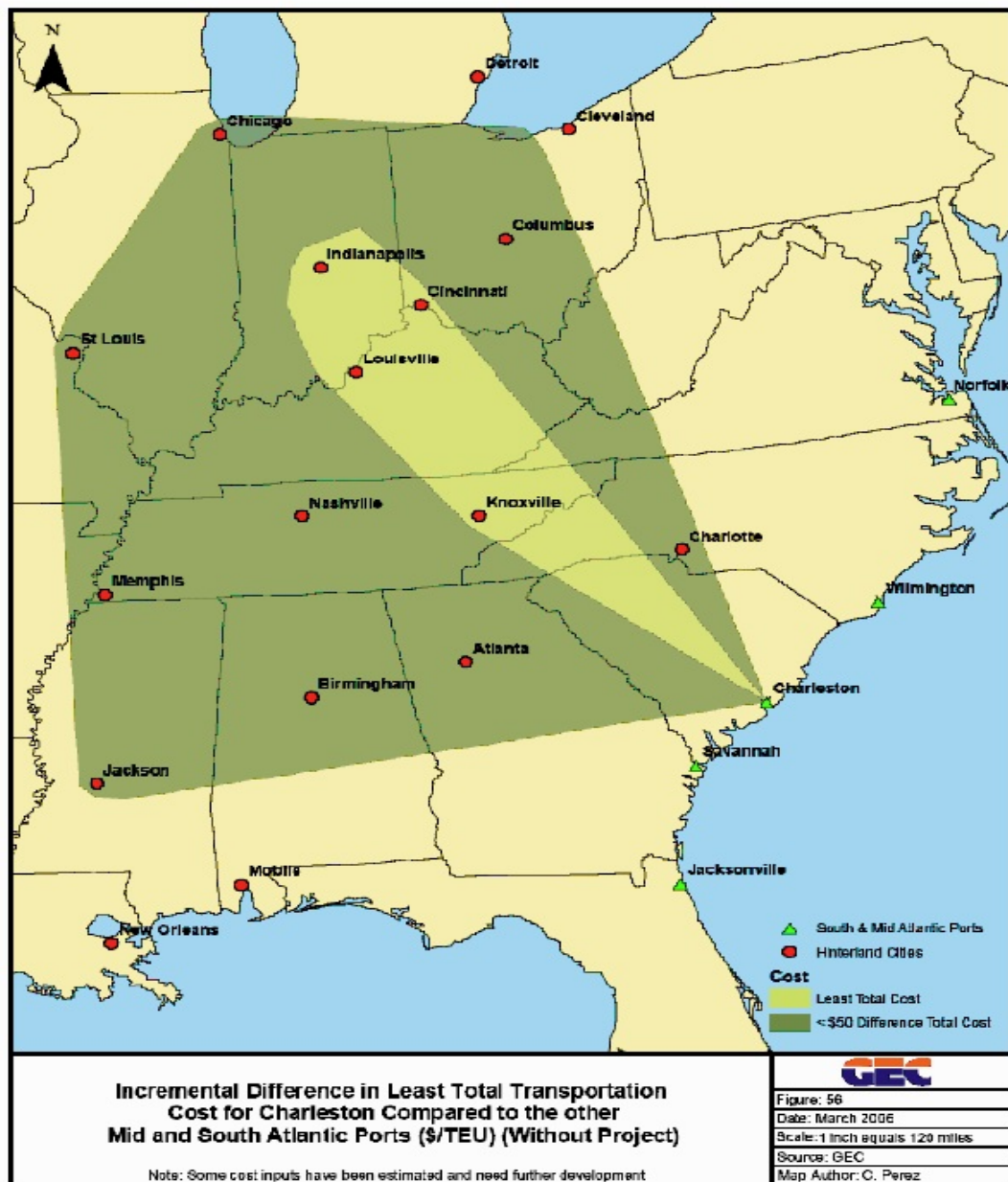
³² Image from Kimley-Horn and Associates website.

Figure A4: Port of Wilmington Cost Advantage by Region³³



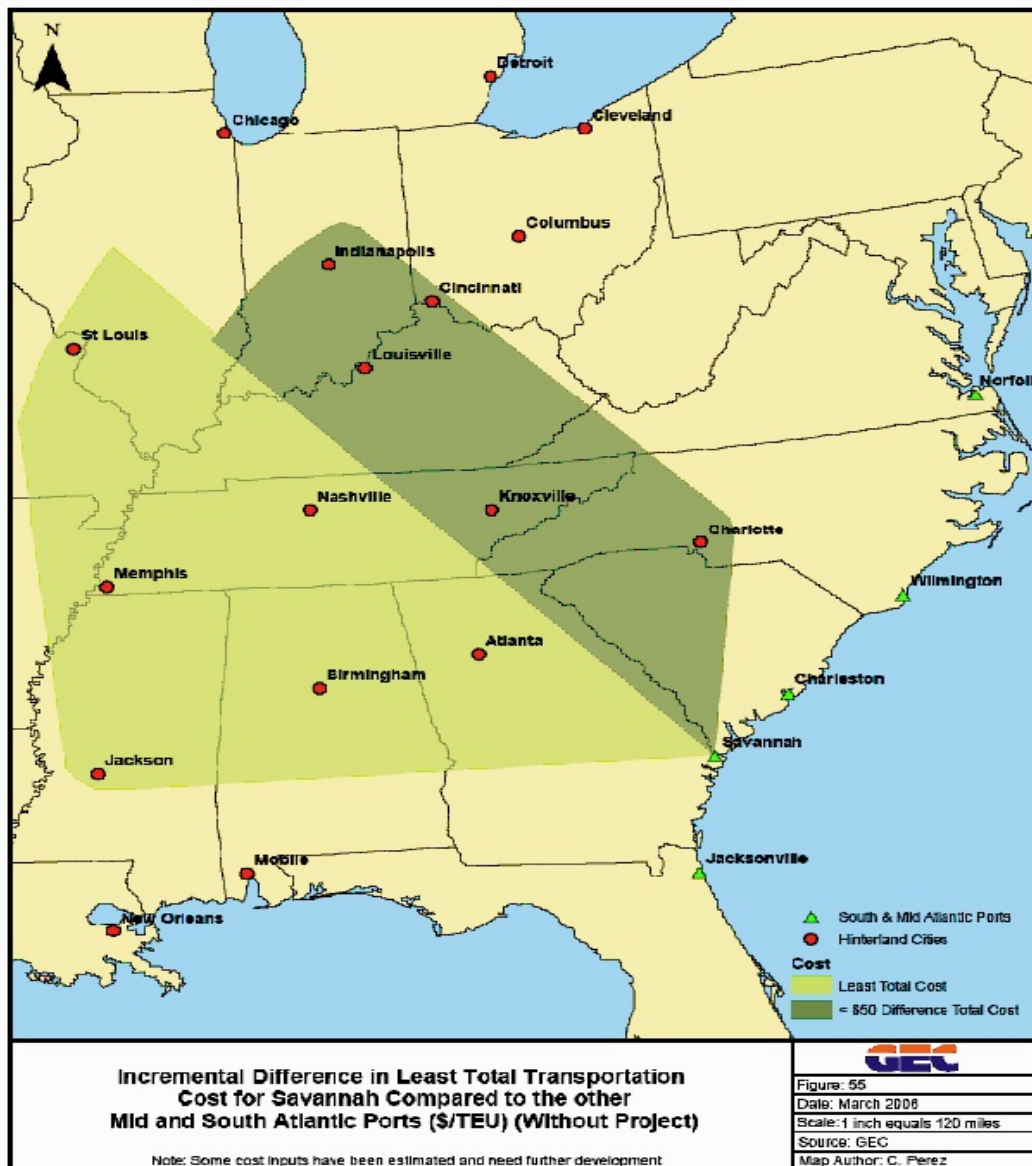
³³ Risingwater Associates, p. 28.

Figure A5: Port of Charleston Cost Advantage by Region³⁴



³⁴ Risingwater Associates, p. 18.

Figure A6: Port of Savannah Cost Advantage by Region³⁵



³⁵ Risingwater Associates, p. 22.

SECTION 7: BIBLIOGRAPHY

- Ackerman, Jon. October 2013. "The Panama Canal Expansion: How Will It Affect The US?" *Load Delivered Logistics*.
- America 2050. 2014. "Piedmont Atlantic." *Regional Plan Association*.
http://www.america2050.org/piedmont_atlantic.html
- Barris, Michael. September 2013. "US states laud China's lifting of ban on hardwood logs." *China Daily USA*. < http://usa.chinadaily.com.cn/us/2013-09/16/content_16971420.htm>
- CanagaRetna, Sujit. June 2010. "The Panama Canal Expansion and SLC State Ports." *Southern Leadership Conference*.
- CH2M Hill, Inc., on behalf of the North Carolina State Ports Authority. August 2008. "A Look at the Preliminary Plan for the proposed North Carolina International Terminal." < <http://www.starnewsonline.com/assets/pdf/WM12788827.PDF>>
- Clifford, Michelle. November 2012. "Economic Impact of the Panama Canal Expansion in the NJ Industrial Market." *Cassidy Turley Commercial Real Estate Services*.
- Container Transport. "Container Ships." *The geography of transport systems*.
- Ebregt and van Leeuwen. 2014. "CPB World Trade Monitor (including January 2014)." CPB Netherlands Bureau of Economic Policy Analysis.
- Ehl, Larry. November 2012. "Feds OK Savannah Port Dredging for Panama Canal Traffic." *Transportation Issues Daily*.
- Federal Highway Administration, US Department of Transportation. "Freight Analysis Framework." <http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/>
- Mitchell, Charles. 2011. "Impact of the Expansion of the Panama Canal: An Engineering Analysis." *Working Paper*.
- Kimley-Horn and Associates. "Super 70 Corridor Projects." < <http://www.kimley-horn.com/Projects/Super70/projects.htm>>
- Knight, Kevin. US Army Corps of Engineers. 2008. "The Implications of Panama Canal Expansion to U.S. Ports and Coastal Navigation Economic Analysis." *Institute for Water Resources*.
- Kriel and Dowsett. February 2014. "Deadline looms as Panama Canal, consortium

- seek to end cost dispute.” *Global Post*.
<<http://www.globalpost.com/dispatch/news/thomson-reuters/140218/deadline-looms-panama-canal-consortium-seek-end-cost-dispute>>
- Johnson, Bill. 2012. “Ports and Shippers Prepare for the Post-Panamax Age.” *Inbound Logistics*. <<http://www.inboundlogistics.com/cms/article/ports-and-shippers-prepare-for-the-post-panamax-age/>>
- List, George et al. December 2011. “Seven Portals Study: An Investigation of How Economic Development Can Be Encouraged in North Carolina Through Infrastructure Investment.” *Governor’s Logistics Task Force and North Carolina Department of Transportation*.
- Martin Associates. May 2012. “The Economic Impact of the Port of Houston.” *Port of Houston Authority*. <<http://www.portofhouston.com/static/gen/about-us/Misc/PHA-EconomicImpact-2012-Summary.pdf>>
- National Association of Development Organizations Research Foundation. February 2012. “Freight Transportation and Economic Development: Planning for the Panama Canal Expansion.”
- News Releases. July 2012. “NC Ports End FY 12 With Volume and Revenue Increases.” *North Carolina State Ports Authority*. <<http://www.ncports.com/news/news-releases/nc-ports-end-fy-12-volume-and-revenue-increases/>>
- North Carolina Department of Transportation, AECOM in association with URS. 2012. “NC Maritime Strategy Final Report.”
- North Carolina State Ports Authority. “Port Statistics.” *NC Department of Transportation*. <<http://www.ncports.com/port-of-wilmington/port-statistics>>
- O’Reilly, Joseph. 2012. “Panama Canal: More Questions than Answers.” *Inbound Logistics*. <<http://www.inboundlogistics.com/cms/article/panama-canal-more-questions-than-answers/>>
- Risingwater Associates. January 2011. “A Look at Container Ports Available to North Carolina Exporters and Importers.” *Save the Cape, Inc.*
- US Army Corps of Engineers. June 2012. “US Port and Inland Waterways Modernization: Preparing for Post-Panamax Vessels.” *Institute for Water Resources*.